

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:
a semiconductor substrate;
gate insulators formed on said substrate, and
gate electrodes formed on said gate
insulators,
said gate insulators which are mainly composed of a
material selected from titanium oxide, zirconium oxide
and hafnium oxide and in which compression strain is
produced, and said semiconductor device equipped with
MOS transistors.
2. A semiconductor device comprising:
a semiconductor substrate,
gate insulators formed on said substrate, and
gate electrodes formed on said gate
insulators,
said gate insulators which are mainly composed of
titanium oxide having a rutile crystal structure and in
which compression strain is produced, and said
semiconductor device equipped with MOS transistors.
3. A semiconductor device comprising:
a semiconductor substrate,
gate insulators formed on said substrate, and
gate electrodes formed on said gate
insulators,
said gate insulators being mainly composed of titanium
oxide having a rutile crystal structure, and said
semiconductor device equipped with MOS transistors,

wherein the thermal expansion coefficient of the main composing material of said gate electrodes is greater than the linear expansion coefficient of said titanium oxide.

4. A semiconductor device comprising:
a semiconductor substrate;
gate insulators formed on said substrate, and
gate electrodes formed on said gate
insulators,
said gate insulators which are mainly composed of
titanium oxide having a rutile crystal structure and in
which compression strain is produced while tensile
strain is produced in the gate electrode, and said
semiconductor device equipped with MOS transistors.

5. A semiconductor device according to claim 1,
wherein said insulator comprises a film mainly composed
of silicon oxide and an overlying film mainly composed
of a material selected from titanium oxide, zirconium
oxide and hafnium oxide.

6. A process for producing a semiconductor
device comprising the steps of:
depositing titanium oxide having a rutile
crystal structure on one principal surface of a
semiconductor substrate to form gate insulators mainly
composed of said rutile titanium oxide, and
forming gate electrode films on said gate
insulators.

7. A process for producing a semiconductor

device comprising the steps of:

depositing titanium oxide on one main principal surface of a semiconductor substrate by chemical vapor deposition at 650°C or above to form gate insulators mainly composed of titanium oxide, and forming gate electrode films on said gate insulators.

8. A process according to claim 5, wherein the said step of forming gate insulators comprises the steps of:

forming a film mainly composed of silicon oxide, and

forming thereon a film mainly composed of an oxide material having higher permittivity than said silicon oxide.

9. A semiconductor device comprising:

a semiconductor substrate, and
MOS transistors formed on said substrate and each having a gate insulator and a gate electrode formed on said gate insulator, wherein a first MOS transistor has a gate insulator mainly composed of a material selected from titanium oxide, zirconium oxide and hafnium oxide, and a second MOS transistor has a gate insulator containing silicon oxide in a high proportion.

10. A semiconductor device according to claim 9, wherein the first MOS transistor is a transistor used for calculations or memories, and the second MOS

transistor is a transistor used for I/O.

11. A semiconductor device comprising:
a semiconductor substrate,
gate insulators formed on said substrate, and
gate electrodes formed on said gate
insulators,
said gate insulators which have a multilayered
structure mainly composed of a material selected from
titanium oxide, zirconium oxide and hafnium oxide and
in which compression strain is produced, and said
semiconductor device equipped with MOS transistors.

12. A semiconductor device equipped with MOS
transistors having titanium oxide gate insulators
interposed between a semiconductor substrate and gate
electrodes, wherein the main crystal structure of said
titanium oxide is anatase, and the state of strain of
the channel region of said semiconductor substrate is
tensile strain.

13. A semiconductor device according to claim 12,
wherein a silicon oxide film or a titanium silicate
film is interposed between said semiconductor substrate
and said titanium oxide gate insulators.

14. A semiconductor device according to claim 12,
wherein said gate electrodes have a phosphorus- or
boron-added polycrystalline silicon film, and a silicon
oxide film or a titanium silicate film is interposed
between said gate electrodes and said titanium oxide
gate insulators.

15. A semiconductor device according to claim 12, wherein said gate electrodes comprise a tungsten film, a molybdenum film, a tungsten nitride film, a tungsten boride film, a tungsten silicide film, or a laminate thereof.

16. A semiconductor device according to claim 12, wherein said gate electrodes comprise a ruthenium oxide film which is in contact with said titanium oxide gate insulator.